From Long Term Classroom Programs and Medium / Short Classroom Program 4 in Top 10, 10 in Top 20, 43 in Top 100, 75 in Top 200, 159 in Top 500 Ranks & 3542 total selections in IIT-JEE 2012

ALL INDIA TEST SERIES

FIITJEE

# JEE (Advanced), 2013

## CONCEPT RECAPITULATION TEST
## (Set – V)

**Paper 1**

**Time Allotted: 3 Hours** **Maximum Marks: 210**

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

## INSTRUCTIONS

### A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains Three Parts.
3. **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
4. Each part is further divided into two sections: **Section-A & Section-C**
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

### B. Filling of OMR Sheet

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with black pen for each character of your Enrolment No. and write your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.

### C. Marking Scheme For All Three Parts.

**(i)** **Section-A (01 to 10)** contains 10 multiple choice questions which have only one correct answer. Each question carries **+3 marks** for correct answer and **– 1 mark** for wrong answer.

**Section-A (11 to 15)** contains 5 multiple choice questions which have more than one correct answer. Each question carries **+4 marks** for correct answer. There is no negative marking.

**(ii)** **Section-C (01 to 05)** contains 5 Numerical based questions with answers as numerical value and each question carries **+4 marks** for correct answer. There is no negative marking.

| | |
|---|---|
| **Name of the Candidate** | |
| **Enrolment No.** | |

## Useful Data

### PHYSICS

| | |
|---|---|
| Acceleration due to gravity | $g = 10\ m/s^2$ |
| Planck constant | $h = 6.6 \times 10^{-34}$ J-s |
| Charge of electron | $e = 1.6 \times 10^{-19}$ C |
| Mass of electron | $m_e = 9.1 \times 10^{-31}$ kg |
| Permittivity of free space | $\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/N\text{-}m^2$ |
| Density of water | $\rho_{water} = 10^3\ kg/m^3$ |
| Atmospheric pressure | $P_a = 10^5\ N/m^2$ |
| Gas constant | $R = 8.314\ J\ K^{-1}\ mol^{-1}$ |

### CHEMISTRY

| | | | |
|---|---|---|---|
| Gas Constant | R | = | $8.314\ J\ K^{-1}\ mol^{-1}$ |
| | | = | $0.0821$ Lit atm $K^{-1}\ mol^{-1}$ |
| | | = | $1.987 \approx 2$ Cal $K^{-1}\ mol^{-1}$ |
| Avogadro's Number | $N_a$ | = | $6.023 \times 10^{23}$ |
| Planck's constant | h | = | $6.625 \times 10^{-34}$ J·s |
| | | = | $6.625 \times 10^{-27}$ erg·s |
| 1 Faraday | | = | 96500 coulomb |
| 1 calorie | | = | 4.2 joule |
| 1 amu | | = | $1.66 \times 10^{-27}$ kg |
| 1 eV | | = | $1.6 \times 10^{-19}$ J |

Atomic No: H=1, He = 2, Li=3, Be=4, B=5, C=6, N=7, O=8, N=9, Na=11, Mg=12, Si=14, Al=13, P=15, S=16, Cl=17, Ar=18, K =19, Ca=20, Cr=24, Mn=25, Fe=26, Co=27, Ni=28, Cu = 29, Zn=30, As=33, Br=35, Ag=47, Sn=50, I=53, Xe=54, Ba=56, Pb=82, U=92.

Atomic masses: H=1, He=4, Li=7, Be=9, B=11, C=12, N=14, O=16, F=19, Na=23, Mg=24, Al = 27, Si=28, P=31, S=32, Cl=35.5, K=39, Ca=40, Cr=52, Mn=55, Fe=56, Co=59, Ni=58.7, Cu=63.5, Zn=65.4, As=75, Br=80, Ag=108, Sn=118.7, I=127, Xe=131, Ba=137, Pb=207, U=238.

# Physics

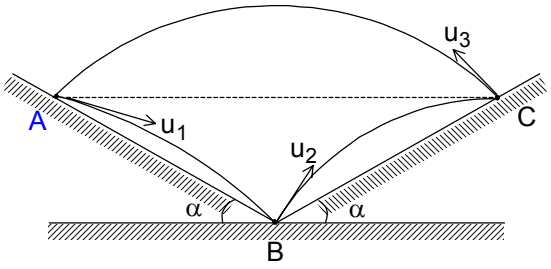
## PART – I

## SECTION – A

### Single Correct Choice Type

This section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1 Three particles are projected in air with the minimum possible speeds, such that the first goes from A to B, the second goes from B to C and the third goes from C to A. Points A and C are at the same vertical level. The two inclines make the same angle $\alpha$ with the horizontal as shown. Then the relation among the projection speeds of the three particles is



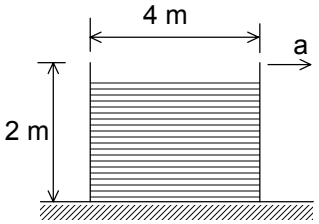

(A) $u_3 = u_1 + u_2$

(B) $u_3^2 = 2u_1u_2$

(C) $\frac{1}{u_3} = \frac{1}{u_1} + \frac{1}{u_2}$

(D) $u_3^2 = u_1^2 + u_2^2$

2. A liquid is filled in a rectangular vessel of dimension 4 m $\times$ 3 m $\times$ 2 m. Now the container starts to move with uniform acceleration, a = 1.25 m/s$^2$ at t = 0. The volume of liquid in vessel is 18m$^3$. The speed of liquid coming out from a very small orifice made at bottom of right side wall at t = 4s is (as seen from the ground frame)




(A) zero

(B) $\sqrt{30}$ m / s

(C) 5 m/s

(D) 10 m/s

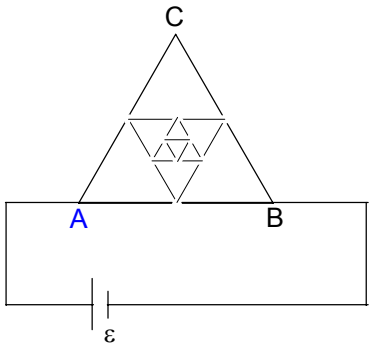
3. An amount Q of heat is added to a mono-atomic ideal gas in a process in which the gas performs a work $\frac{Q}{2}$ on its surroundings. The molar heat capacity for the process is

(A) 2R (B) $\frac{5R}{3}$

(C) 3R (D) none of these

***Rough work***

4. A frame made of thin homogeneous wire of resistance per unit length 'r' is connected with a battery of emf $\varepsilon$ between the terminals A and B as shown in the figure. The frame ABC is in the form of equilateral triangle and the number of successively embedded equilateral triangle (with sides decreasing by half) tends to infinity. The side length of equilateral triangle ABC is a. The value of current flowing through the battery is



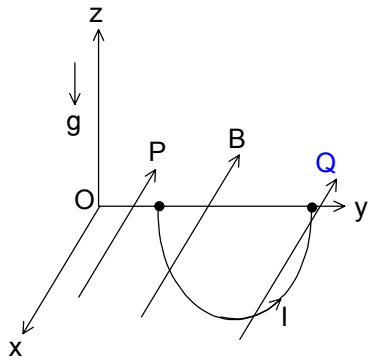

(A) $\varepsilon$ / ar

(B) $\left(2\sqrt{3}+1\right)\varepsilon$ / ar

(C) $\dfrac{\left(\sqrt{7}+1\right)\varepsilon}{2ar}$

(D) zero

5. A semicircular wire of radius 'a' carries a current I and lies in a horizontal plane (x-y plane) with its ends P and Q hinged on the y-axis as shown in the figure. A uniform magnetic field $\vec{B} = -B\vec{i}$ exists in the space. The acceleration due to gravity is 'g'. If the loop is released, it is found to stay in horizontal position in equilibrium. The mass of the loop is




(A) $\dfrac{2aBI}{g}$ (B) $\dfrac{\pi a^2 BI}{2g}$

(C) $\dfrac{aBI}{g}$ (D) $\dfrac{\pi^2 aBI}{4g}$

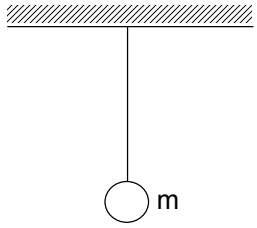
6. A thin glass plate of thickness 0.2$\mu$m and refractive index $\mu$ = 1.5 is placed just after upper slit in a Young's double slit experiment. The intensity at the centre of the screen is I. What was the intensity at the same point prior to the introduction of the sheet? (The wavelength of incident light is 600 nm)

(A) I (B) $\dfrac{I}{2}$

(C) $\dfrac{4I}{3}$ (D) $\dfrac{5I}{4}$

***Rough work***

7. A small body of mass m is suspended with the help of light cord of force constant $K = \frac{2mg}{\ell}$. Initially block is at rest and the extension in the cord is $\frac{\ell}{2}$. Now, it is displaced downward from equilibrium by distance $\ell$ and released. (Neglect energy loss in cord). The time period of oscillation is




(A) $2\pi\sqrt{\frac{\ell}{2g}}$ (B) $2\pi\sqrt{\frac{\ell}{g}}$

(C) $\frac{4\pi}{3}\sqrt{\frac{\ell}{2g}}+\sqrt{\frac{6\ell}{g}}$ (D) $\pi\sqrt{\frac{\ell}{2g}}+\sqrt{\frac{8\ell}{g}}$

8. A radioactive isotope is being formed at a constant rate K. At t = 0, the number of active nuclei is $N_o$. The decay constant of isotope is $\lambda$. The number of active nuclei

(A) first increases then decreases (B) goes on increasing

(C) goes on decreasing (D) is $\frac{K}{\lambda}$ after a time $t >> \frac{1}{\lambda}$

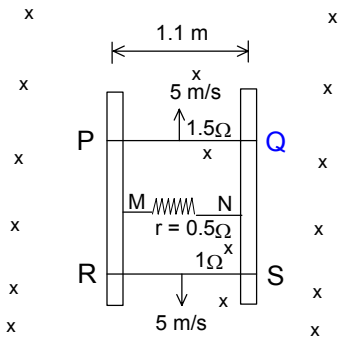
9. A close organ pipe of diameter 10 cm has length 42 cm. The air column in pipe vibrates in its second overtone with the maximum amplitude $\Delta P_o$. The pressure amplitude at middle of pipe is

(A) $\frac{\Delta P_o}{2}$ (B) $\frac{\Delta P_o}{\sqrt{2}}$

(C) $\frac{\sqrt{3}\Delta P_o}{2}$ (D) $\Delta P_o$

10. Consider the situation shown in figure, wires PQ & RS are free to slide on the fixed rails separated by 1.1 m with constant velocity as shown in figure. The resistance of wires PQ & RS are 1.5Ω and 1Ω respectively. The magnetic field B (acting into the plane of the paper) equals 2 tesla. The current in resistor r = 0.5Ω is

(A) zero
(B) 1 A from M to N
(C) 2 A from N to M
(D) none of these

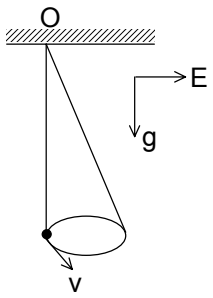



***Rough work***

## Multiple Correct Answer(s) Type

This section contains **5 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE are correct**.

11. A positively charged particle of charge q and mass m is suspended from a point O by a string of length $\ell$. In the space a uniform horizontal electric field E exists. The particle is drawn aside so that the string becomes vertical and then it is projected horizontally with velocity v such that the particle starts to move along a circle with same constant speed v.



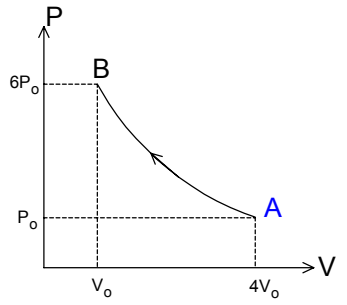

(A) tension in string is $\sqrt{(mg)^2+(qE)^2}$

(B) tension in string is $mg\left[1+\left(\frac{qE}{mg}\right)^2\right]$

(C) kinetic energy of mass is $\frac{q^2E^2\ell}{2mg}$

(D) kinetic energy of mass is $\frac{5}{2}m\ell\sqrt{g^2+\frac{q^2E^2}{m^2}}$

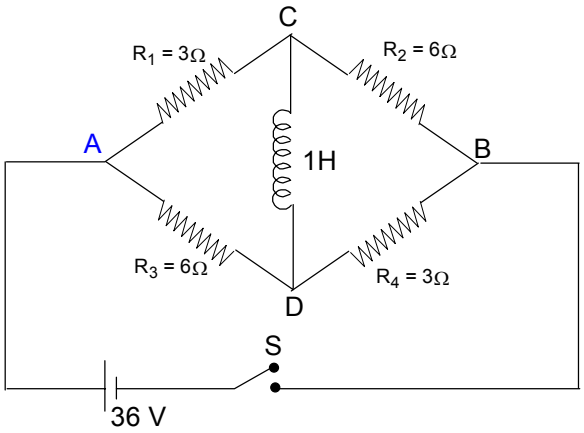
12. One mole of a diatomic gas is taken through a process A $\rightarrow$ B as shown in the figure. The gas obeys the relation
$Q_{A\rightarrow B}+W_{A\rightarrow B}=0$




(A) the molar heat capacity for process AB is 5R/4
(B) the heat supplied in the process is (5/2) $P_0V_0$
(C) for A to B, temperature decreases from A to B
(D) the temperature increases from A to B

***Rough work***

13. The switch S is closed at t = 0 as shown in the figue.



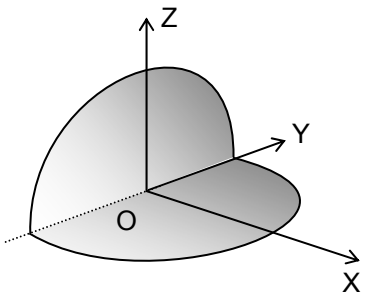

(A) the current as function of time in the inductor is $3(1 - e^{-4t})$A.

(B) the current through $R_1$ just after closing of switch is 8A

(C) the power supply by the battery as function of time is $36(9 - e^{-4t})$

(D) the current through $R_2$ after long time closing of switch is 3A

14. Two identical semicircular discs of mass 'm' each and radius 'R' are placed in the XY (horizontal) plane and the YZ (vertical) plane, respectively. They are so placed that they have their common diameter along the Y-axis. Then, the moment of inertia ($I_n$) of the system about the appropriate axis is given by




($I_n$ refers to moment of inertia about axis n-where n is X, Y, Z)

(A) $I_X = \frac{1}{2}mR^2$

(B) $I_Y = \frac{1}{2}mR^2$

(C) $I_Z = \frac{3}{4}mR^2$

(D) $I_X = I_Y = I_Z$

15. The position of a particle moving in a straight line is given by

$x = 3t^3 - 18t^2 + 36t$

Here, x is in m and t in second. Then

(A) direction of velocity and acceleration both change at t = 2s

(B) the distance travelled by particle is equal to magnitude of displacement for t = 0 to t = 5s

(C) the speed of particle is decreasing in t = 0 to t = 2s then it is increasing for t > 2s

(D) the magnitudes of velocity and acceleration are equal at t = 0

***Rough work***

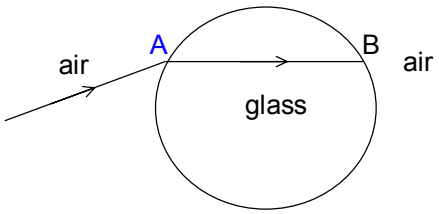
## SECTION –C

### Integer Answer Type

This section contains **5 questions.** The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).

1. Two identical ball collide elastically with each other. Ball B was in rest and ball A had speed u at an angle of $60^o$ with line joining the centre of two balls before collision. The speed of ball B after collision is u/K. Find K ……..

2. A ray is incident on a spherical glass ball placed in air, as shown in the figure. The refractive index of air at A is slightly higher than the refractive index of air at B, so that total internal reflection takes place at B. Then the angle of incidence at A is $(10n)^o$. Here n is ……..




3. $K_\alpha$ wavelength emitted by an atom of atomic number z = 11 is $\lambda$. Find the atomic number of an atom that emits $K_\alpha$ radiation of wavelength $4\lambda$.

4. Binary stars rotate under mutual gravitational force at separation $2\left(\frac{G}{\omega^2}\right)^{\frac{1}{3}}$, where $\omega$ is the angular velocity of each of the star about centre of mass of the system. If difference between the mass of stars is 6 units. Find the ratio of masses of bigger star to smaller star.

5. A simple pendulum has time period T when on the earth's surface and $T_2$ when taken in a tunnel at depth 3R/4 along the diameter of earth, where R is the radius of earth. The value of $T_2/T_1$.

***Rough work***

# *Chemistry* PART – II

## SECTION – A

### Straight Objective Type

This section contains 10 multiple choice questions numbered 1 to 10. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

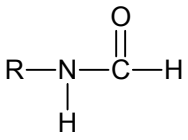
1. Which pair of compounds is expected to show similar colour in aqueous medium:
   (A) $FeCl_3$ *and* $ZnCl_2$ (B) $VOCl_2$ *and* $CuCl_2$
   (C) $VOCl_2$ *and* $ZnCl_2$ (D) $ZnCl_2$ *and* $MnCl_2$

2. At 25°C the pH of 0.01 M KOH is 12. If the temperature of this solution is raised to 50°C without changing the volume, which of the following is correct?
   (A) Both pH and pOH will remain constant
   (B) pH will decrease while pOH will remain constant
   (C) pH will increase while pOH will remain constant
   (D) pH will increase while pOH will decrease

3. $COCl_2 + RNH_2 \longrightarrow$ End product is

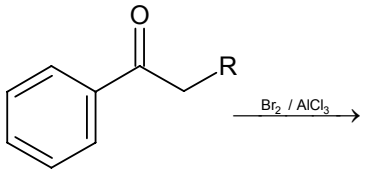
   (A) RNHCONHR (B) RCNO

   (C) RNCO (D)

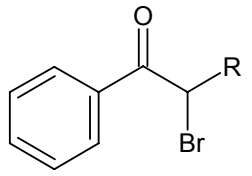


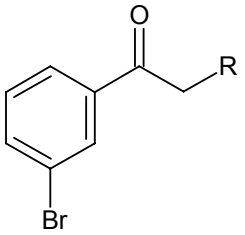
4. Which is correct?
   (A) All alkali metal bicarbonates exist in solid state
   (B) All alkaline earth metal bicarbonates do not exist in solid state
   (C) All alkali metal halides are water soluble except LiI
   (D) Reactivity of alkaline earth metals for $N_2$ increases down the group

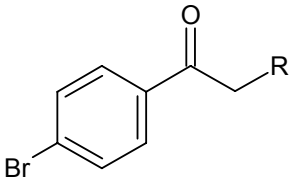
***Rough Work***

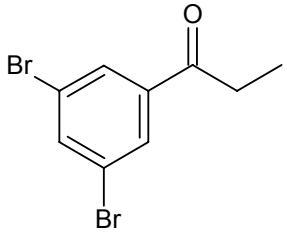
5. 

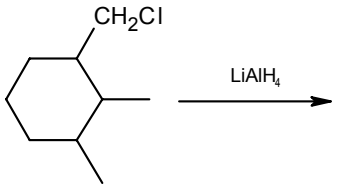
Product (major). Product is

(A) 


(B) 


(C) 


(D) 


6. 

'P'
(doesn't decolorise $Br_2/CCl_4$ solution)

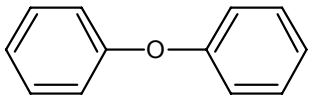
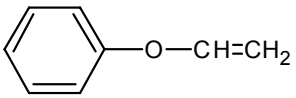
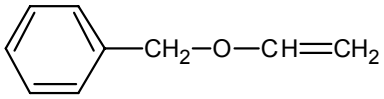
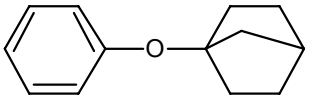
Choose correct option
(A) compound 'P' exhibit stereoisomerism with one meso form.
(B) compound 'P' exhibit stereoisomerism with two meso form.
(C) compound 'P' doesn't exhibit stereoisomerism
(D) all the stereoisomers of 'P' can rotate the plane of polarized light.

7. An anhydrous white solid which is soluble in $NH_4OH$ & NaOH and forms white precipitate with $Na_2CO_3$ and with $H_2S$. The anhydrous compound could be
(A) $ZnCl_2$ (B) $CaCl_2$
(C) $CaCl_2$ (D) $CuSO_4$

***Rough Work***

8. Consider following statements regarding $N_2O$.
(i) it is linear and symmetrical molecule
(ii) it is linear and unsymmetrical molecule.
(iii) it exhibits resonance.
(iv) it has small value of dipole moment.
Which of the following statement(s) is/are correct.
(A) only (ii) (B) (ii) & (iii)
(C) (ii) & (iv) (D) (ii), (iii) & (iv)

9. How many electron pair (bond pair or lone pair) affects dipole moment in $PH_3$?
(A) 4 (B) 0
(C) 3 (D) 1

10. Which of the following ether can be cleaved using HBr or HI?
(A) 
(B) 
(C) 
(D) 

***Rough Work***

**Multiple Correct Choice Type**

This section contains 5 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out which **ONE OR MORE** is/are correct.

11. If adsorption of a gas on a solid is limited to monolayer formation, then which of the following statements are true?

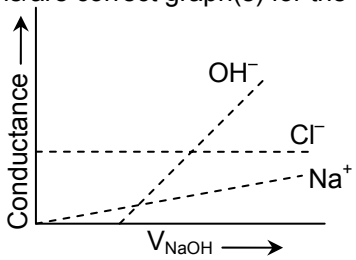
(A) At low pressure, $\frac{x}{m}$ varies proportionately with p

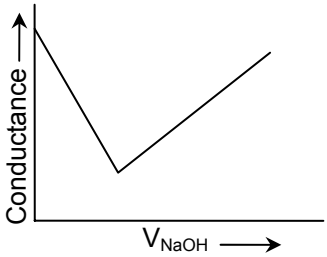
(B) At moderate pressures, $\frac{x}{m}$ varies less than proportionately with p

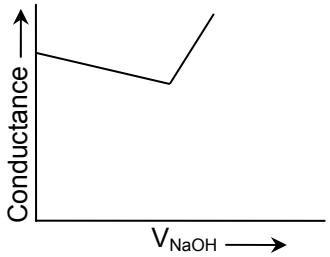
(C) At high pressures, $\frac{x}{m}$ becomes independent of p

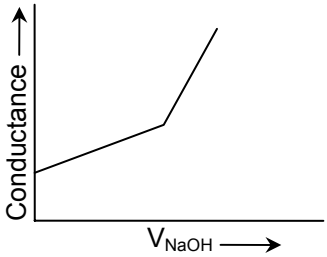
(D) At high pressures, $\frac{x}{m}$ varies more than proportionately with p

12. Which is/are correct graph(s) for the titration of HCl vs NaOH?

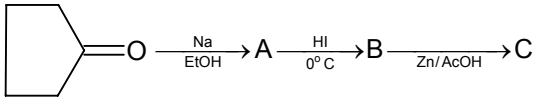
(A)



(B)



(C)



(D)



***Rough Work***

13. 


Which of the following are incorrect?

(A) A does not give haloform test

(B) B does not give ppt. of AgI when treated with $AgNO_3$

(C) C is a alkyl halide

(D) A is a Pinacol

14. $R_2CO + CH_2N_2 \longrightarrow$ Products

Product contains

(A) Ketone (B) Epoxide

(C) $N_2$ (D) Amide

15. The coagulation of negatively charged sol particles may be effected by:

(A) adding positively charged sol

(B) heating

(C) adding electrolyte

(D) persistent dialysis

***Rough Work***

## SECTION – C

### Integer Answer Type

This section contains **5 questions.** The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).

1. How many methanides are present in the following carbides?
   SiC, $CaC_2$, $Be_2C$, $Al_2C_6$, $Al_4C_3$, $B_4C$.

2. How many $\pi$-electron pairs are present in ferrocene?

3. A hydrocarbon **A** of molecular formula $C_6H_{12}$ does not react with bromine water but reacts with bromine in presence of sunlight, forming compound **B**. Compound **B** on treatment with alcoholic KOH gives **C** which on ozonolysis gives **D** as the only organic product. Compound **D** reduces ammoniacal silver nitrate solution and gives **E**. **E** gives iodoform test and produces compound **F** which on acidification followed by heating with $P_4O_{10}$ forms a cyclic anhydride **G**. The sum of $\pi$ bonds in **A** to **G** is 3k. Then the value of k is:

4. In a balance reaction
   $aHgS + bHCl + cHNO_3 \longrightarrow xH_2HgCl_4 + yNO + dS + eH_2O$
   the value of c + d + y is ……..

5. $RCHO + HNO_3 \xrightarrow{H_2SO_4} A + B + C$
   How many total $\pi$ bonds are present in a mixture of A, B and C (each one molecule)?

***Rough Work***

# Mathematics PART – III

## SECTION – A

### Straight Objective Type

This section contains **10 multiple choice questions** numbered 1 to 10. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. The area of the smaller region in which the curve $y = \left[\frac{x^3}{100} + \frac{x}{50}\right]$ where [.] denotes the greatest integer function, divides the circle $(x-2)^2 + (y+1)^2 = 4$, is equal to

(A) $\frac{2\pi - 3\sqrt{3}}{3}$ sq. units (B) $\frac{3\sqrt{3} - \pi}{3}$ sq. units

(C) $\frac{4\pi - 3\sqrt{3}}{3}$ sq. units (D) $\frac{5\pi - 3\sqrt{3}}{3}$ sq. units

2. In any triangle ABC, the sides a, b, c are in G.P. with common ration $r(r > 1)$, then

(A) $r < \frac{1}{2}\left(\sqrt{5}+1\right)$ (B) $r < \frac{1}{2}\left(\sqrt{5}-1\right)$

(C) $A < \frac{\pi}{3} < B < C$ (D) $A = B < C$

3. The number of solutions of the equation $\sec x = \frac{\pi}{2}$ in the interval $\left(-\frac{\pi}{2}, \frac{\pi}{4}\right)$ is

(A) 0 (B) 1
(C) 2 (D) 4

4. Let $f(x) = \underset{n\to\infty}{Lt} \frac{1}{\left(\frac{3}{\pi}\tan^{-1}2x\right)^{2n} + 5}$. Then the set of values of $x$ for which $f(x) = 0$, is

(A) $|2x| > \sqrt{3}$ (B) $|2x| < \sqrt{3}$

(C) $|2x| \geq \sqrt{3}$ (D) $|2x| \leq \sqrt{3}$

***Rough work***

5. $f(x)=\begin{cases} x^a \ell n\, x & : \quad x>0 \\ 0 & \text{if} \quad x=0 \end{cases}$.

If Lagrange's theorem applies to f on [0, 1] then 'a' can be

(A) –2 (B) –1

(C) 0 (D) $\frac{1}{2}$

6. $f(x)=\left(\sin^2 x\right)e^{-2\sin^2 x}$; $\max f(x)-\min f(x)=$

(A) $\frac{1}{e^2}$ (B) $\frac{1}{2e}-\frac{1}{e^2}$

(C) 1 (D) None of these

7. Let $f(x)=\begin{cases} x^p \sin\left(\frac{1}{x}\right)+x\left|x^3\right|, & x\neq 0 \\ 0, & x=0 \end{cases}$ the set of values, of p for which f''(x) is continuous at x = 0 is

(A) [2, ∞) (B) [–3, ∞)

(C) [5, ∞) (D) [–2, ∞)

8. Which of the following functions are differentiable in (–1, 2)?

(A) $\int_x^{2x}(\log x)^2\,dx$ (B) $\int_x^{2x}\frac{\sin x}{x}dx$

(C) $\int_0^x \frac{1-t+t^2}{1+t+t^2}dt$ (D) none of these

9. If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar vectors such that $\vec{b}\times\vec{c}=\vec{a}, \vec{a}\times\vec{b}=\vec{c}$ and $\vec{c}\times\vec{a}=\vec{b}$, then the value of $[\vec{a}, \vec{b}, \vec{c}]$ is

(A) 1 (B) 2

(C) 3 (D) 4

10. If |z| = 1 and $w=\frac{z-1}{z+1}$ (where $z\neq -1$), then the real part of w is

(A) 1/2 (B) 1/4

(C) 0 (D) none of these

***Rough work***

**Multiple Correct Answer(s) Type**

This section contains **5 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE are correct**.

11. If $\sin\theta = a$ has exactly 3 solutions in $\theta \in \left[0, \frac{7\pi}{3}\right]$ then the value of 'a' is

(A) $\frac{\sqrt{10+2\sqrt{5}}}{4}$ (B) $\frac{\sqrt{5}-1}{4}$

(C) $\frac{\sqrt{5}+1}{4}$ (D) $\frac{\sqrt{3}+1}{2\sqrt{2}}$

12. If $\sin 47^0 + \sin 61^0 - \sin 11^0 - \sin 25^0 = \lambda$ then

(A) $\lambda = \cos 7^0$ (B) $\lambda > \frac{\sqrt{3}+1}{2\sqrt{2}}$

(C) $\lambda < \frac{\sqrt{5}+1}{4}$ (D) $\lambda < \cos 1$

13. If $\int_0^x \left(x - [x] - \frac{1}{2}\right) dx = f(x).g(x)$ where $[x]$ and $\{x\}$ are integral and fractional parts of x, respectively

(A) $f(x) = \frac{\{x\}}{2}$ (B) $g(x) = (\{x\} - 1)$

(C) $f(x) = \frac{[x]}{2}$ (D) $g(x) = ([x] - 1)$

14. If $2f(x) + xf\left(\frac{1}{x}\right) - 2f\left(\left|\sqrt{2}\sin\pi\left(x + \frac{1}{4}\right)\right|\right) = 4\cos^2\left(\frac{\pi x}{2}\right) + x\cos\frac{\pi}{x}, \forall x \in R - \{0\}$ then which of the following statement(s) is/are true?

(A) $f(2) + f\left(\frac{1}{2}\right) = 1$ (B) $f(2) + f(1) = 0$

(C) $f(2) + f(1) = f\left(\frac{1}{2}\right)$ (D) $f(1)\, f\left(\frac{1}{2}\right) f(2) = 1$

***Rough work***

15. If each of $\bar{a},\bar{b},\bar{c}$ is orthogonal to the sum of the other two vectors and $|\bar{a}| = 3$, $|\bar{b}| = 4$, $|\bar{c}| = 5$ then which of the following statement(s) is/are true

(A) if $\vec{a}$ makes angles of equal measures with x, y, z axes, then tangent of this angle is $\pm\sqrt{2}$

(B) range of $|\bar{a} - \bar{b}|$ is $[1, 7]$

(C) range of $|\bar{b} - \bar{c}|$ is $[1, 9]$

(D) $|\bar{a} + \bar{b} + \bar{c}| = 2\sqrt{5}$

## SECTION – C

### Integer Answer Type

This section contains **5 questions.** The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).

1. Number of points where function $f(x) = |x^2 - 3x + 2| + \cos|x|$ is not differentiable is _____.

2. Six distinct integers are picked at random from $\{1, 2, 3, ...., 10\}$. If the probability that, among those selected, the second smallest is 3; is M then find 6M _____.

3. If number of subsets {a, b, c} of {–3, –2, –1, 0, 1, 2, 3} such that line $ax + by + c = 0$ makes an acute angle with the positive x-axis is A, then [(A – 1)/7] is _____.

4. Let ABCD be a tetrahedron in which position vectors of A, B, C and D are $\hat{i} + \hat{j} + \hat{k}$, $2\hat{i} + \hat{j} + 2\hat{k}$, $3\hat{i} + 2\hat{j} + \hat{k}$ and $2\hat{i} + 3\hat{j} + 2\hat{k}$. If ABC be the base of tetrahedron and height of tetrahedron is $\left(a\sqrt{\frac{a}{b}}\right)$, where a and b are co-prime, then find a + b _____.

5. $0 < x < \frac{\pi}{4}$ and $\frac{\pi}{4} < y < \frac{\pi}{2}$ & $\sum_{k=0}^{\infty}(-1)^k \tan^{2k} x = p$; $\sum_{k=0}^{\infty}(-1)^k \cot^{2k} y = q$; then find the reciprocal value of $\sum_{k=0}^{\infty} \tan^{2k} x \cot^{2k} y$ is , if p = 1/4 and q = 3 _____.

***Rough work***